

What we claim is:

1. A method of restarting a permanent magnet turbogenerator/motor, comprising the steps of:

determining that the permanent magnet turbogenerator/motor has a fatal fault present and is in the process of shutting down;

determining that the permanent magnet turbogenerator/motor has more than a fixed number of restart attempts since the permanent magnet turbogenerator/motor was determined to have a fatal fault; and

continue shutdown of the permanent magnet turbogenerator/motor.

2. The method of claim 1 wherein the permanent magnet turbogenerator/motor is in a grid connect mode and said step of determining that the permanent magnet turbogenerator/motor has a fatal fault present and is in the process of shutting down comprises the steps of:

detecting an over-current condition;

determining that less than a fixed number of over-current events have occurred within a fixed period of time;

disabling the output power converter of the permanent magnet turbogenerator/motor;

determining that the output current of the permanent magnet turbogenerator/motor is at a

normal level in all phases; and

enabling the output power converter of the permanent magnet turbogenerator/motor to continue normal operation of the permanent magnet turbogenerator/motor.

3. The method of claim 1 wherein the permanent magnet turbogenerator/motor is in a grid connect mode and said step of determining that the permanent magnet turbogenerator/motor has a fatal fault present and is in the process of shutting down comprises the steps of:

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4 detecting no output over-current;  
5 detecting a loss of output current control or a loss of DC bus voltage control;  
6 determining that more than a fixed number of warning faults has occurred within a fixed  
7 period of time;  
8 reporting a grid fatal fault and initiating shutdown of the permanent magnet  
9 turbogenerator/motor.

1 4. The method of claim 1 wherein the permanent magnet turbogenerator/motor is in a  
2 grid connect mode and said step of determining that the permanent magnet turbogenerator/motor  
3 has a fatal fault present and is in the process of shutting down comprises the steps of:

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4 detecting no output over-current;  
5 detecting a loss of output current control or a loss of DC bus voltage control;  
6 determining that less than a fixed number of warning faults has occurred within a fixed  
7 period of time;  
8 reporting a grid unbalance warning fault;  
9 disabling the output power converter of the permanent magnet turbogenerator/motor;  
10 analyzing the grid voltage magnitude and frequency for an acceptable connection; and  
11 enabling the output power converter of the permanent magnet turbogenerator/motor to  
12 continue normal operation of the permanent magnet turbogenerator/motor.

1 5. The method of claim 1 wherein the permanent magnet turbogenerator/motor is in a  
2 grid connect mode and said step of determining that the permanent magnet turbogenerator/motor  
3 has a fatal fault present and is in the process of shutting down comprises the steps of:

4 detecting no output over-current;  
5 detecting a loss of output current control or a loss of DC bus voltage control;

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6 determining that less than a fixed number of warning faults has occurred within a fixed  
7 period of time;  
8 reporting a grid unbalance warning fault;  
9 disabling the output power converter of the permanent magnet turbogenerator/motor;  
10 analyzing the grid voltage magnitude and frequency for an unacceptable connection;  
11 determining that the maximum allowable reconnection time has expired; and  
12 reporting a grid fatal fault and initiating shutdown of the permanent magnet  
13 turbogenerator/motor.

1 6. The method of claim 1 wherein the permanent magnet turbogenerator/motor is in a  
grid connect mode and said step of determining that the permanent magnet turbogenerator/motor  
has a fatal fault present and is in the process of shutting down comprises the steps of:

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2 detecting no output over-current;  
3 detecting a loss of output current control or a loss of DC bus voltage control;  
4 determining that less than a fixed number of warning faults has occurred within a fixed  
5 period of time;  
6 reporting a grid unbalance warning fault;  
7 disabling the output power converter of the permanent magnet turbogenerator/motor;  
10 analyzing the grid voltage magnitude and frequency for an unacceptable connection;  
11 determining that the maximum allowable reconnection time has not expired;  
12 determining that the DC bus level is below the turn on point of the brake resistor;  
13 applying the brake resistor to control DC bus voltage;  
14 determining that the grid is acceptable for connection; and

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15 enabling the output power converter of the permanent magnet turbogenerator/motor to  
16 continue normal operation of the permanent magnet turbogenerator/motor.

1 7. The method of claim 1 wherein the permanent magnet turbogenerator/motor is in a  
2 grid connect mode and said step of determining that the permanent magnet turbogenerator/motor  
3 has a fatal fault present and is in the process of shutting down comprises the steps of:

4 detecting no output over-current;

5 detecting a loss of output current control or a loss of DC bus voltage control;

6 determining that less than a fixed number of warning faults has occurred within a fixed  
7 period of time;

8 reporting a grid unbalance warning fault;

9 disabling the output power converter of the permanent magnet turbogenerator/motor;

10 analyzing the grid voltage magnitude and frequency for an unacceptable connection;

11 determining that the maximum allowable reconnection time has not expired;

12 determining that the DC bus level is below the turn on point of the brake resistor;

13 determining that the grid is acceptable for connection; and

14 enabling the output power converter of the permanent magnet turbogenerator/motor to  
15 continue normal operation of the permanent magnet turbogenerator/motor.

1 8. The method of claim 1 wherein the permanent magnet turbogenerator/motor is in a  
2 grid connect mode and said step of determining that the permanent magnet turbogenerator/motor  
3 has a fatal fault present and is in the process of shutting down comprises the steps of:

4 detecting no output over-current;

5 detecting a loss of output current control or a loss of DC bus voltage control;

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6 determining that less than a fixed number of warning faults has occurred within a fixed  
7 period of time;  
8 reporting a grid unbalance warning fault;  
9 disabling the output power converter of the permanent magnet turbogenerator/motor;  
10 analyzing the grid voltage magnitude and frequency for an unacceptable connection;  
11 determining that the maximum allowable reconnection time has not expired;  
12 determining that the DC bus level is not below the turn on point of the brake resistor;  
13 applying the brake resistor to control DC bus voltage;  
1 determining that the grid is unacceptable for connection;  
determining that the maximum allowable reconnection time has expired; and  
reporting a grid fatal fault and initiating shutdown of the permanent magnet  
turbogenerator/motor.

9. The method of claim 1 wherein the permanent magnet turbogenerator/motor is in a  
grid connect mode and said step of determining that the permanent magnet turbogenerator/motor  
has a fatal fault present and is in the process of shutting down comprises the steps of:

detecting an over-current condition;  
determining that less than a fixed number of over-current events have occurred within a  
6 fixed period of time;  
7 disabling the output power converter of the permanent magnet turbogenerator/motor;  
8 determining that the output current of the permanent magnet turbogenerator/motor is not  
9 at a normal level in all phases;  
10 determining that the DC bus level is not below the turn on point of the brake resistor;  
11 applying the brake resistor to control DC bus voltage;

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12 determining that the output current of the permanent magnet turbogenerator/motor is at a  
13 normal level in all phases; and

14 enabling the output power converter of the permanent magnet turbogenerator/motor to  
15 continue normal operation of the permanent magnet turbogenerator/motor.

1 10. The method of claim 1 wherein the permanent magnet turbogenerator/motor is in a  
2 grid connect mode and said step of determining that the permanent magnet turbogenerator/motor  
3 has a fatal fault present and is in the process of shutting down comprises the steps of:

4 detecting an over-current condition;  
5 determining that less than a fixed number of over-current events have occurred within a  
fixed period of time;

disabling the output power converter of the permanent magnet turbogenerator/motor;  
determining that the output current of the permanent magnet turbogenerator/motor is not  
at a normal level in all phases;

determining that the DC bus level is below the turn on point of the brake resistor;  
determining that the output current of the permanent magnet turbogenerator/motor is at a  
normal level in all phases; and

enabling the output power converter of the permanent magnet turbogenerator/motor to  
14 continue normal operation of the permanent magnet turbogenerator/motor.

1 11. The method of claim 1 wherein the permanent magnet turbogenerator/motor is in a  
2 grid connect mode and said step of determining that the permanent magnet turbogenerator/motor  
3 has a fatal fault present and is in the process of shutting down comprises the steps of:

4 detecting an over-current condition;

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5 determining that more than a fixed number of over-current events have occurred within a  
6 fixed period of time;

7 determining that more than a fixed number of warning faults has occurred within a fixed  
8 period of time;

9 reporting a grid fatal fault and initiating shutdown of the permanent magnet  
10 turbogenerator/motor.

1 12. The method of claim 1 wherein the permanent magnet turbogenerator/motor is in a  
2 standalone mode and said step of determining that the permanent magnet turbogenerator/motor  
3 has a fatal fault present and is in the process of shutting down comprises the steps of:

detecting an over-current condition;

4 determining that less than a fixed number of over-current events have occurred within a  
5 fixed period of time;

6 disabling the output power converter of the permanent magnet turbogenerator/motor;

7 determining that the output current of the permanent magnet turbogenerator/motor is at a  
8 normal level in all phases; and

9 enabling the output power converter of the permanent magnet turbogenerator/motor to  
10 continue normal operation of the permanent magnet turbogenerator/motor.

1 13. The method of claim 1 wherein the permanent magnet turbogenerator/motor is in a  
2 standalone mode and said step of determining that the permanent magnet turbogenerator/motor  
3 has a fatal fault present and is in the process of shutting down comprises the steps of:

4 detecting an over-current condition;

5 determining that more than a fixed number of over current events have occurred within a  
6 fixed period of time;

determining that less than a fixed number of warning faults has occurred within a fixed period of time;

reporting a grid unbalance warning fault;

disabling the output power converter of the permanent magnet turbogenerator/motor,

resetting the output voltage control ready for a soft start; and

enabling the output power converter of the permanent magnet turbogenerator/motor to continue normal operation of the permanent magnet turbogenerator/motor.

14. The method of claim 1 wherein the permanent magnet turbogenerator/motor is in a standalone mode and said step of determining that the permanent magnet turbogenerator/motor has a fatal fault present and is in the process of shutting down comprises the steps of:

detecting an over-current condition;

determining that less than a fixed number of over-current events have occurred within a fixed period of time;

**disabling the output power converter of the permanent magnet turbogenerator/motor;**

determining that the output current of the permanent magnet turbogenerator/motor is not at a normal level in all phases;

determining that the DC bus level is below the turn on point of the brake resistor;

determining that the output current of the permanent magnet turbogenerator/motor is at a normal level in all phases; and

enabling the output power converter of the permanent magnet turbogenerator/motor to continue normal operation of the permanent magnet turbogenerator/motor.

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1 15. The method of claim 1 wherein the permanent magnet turbogenerator/motor is in a  
2 standalone mode and said step of determining that the permanent magnet turbogenerator/motor  
3 has a fatal fault present and is in the process of shutting down comprises the steps of:  
4 detecting an over-current condition;  
5 determining that less than a fixed number of over-current events have occurred within a  
6 fixed period of time;  
7 disabling the output power converter of the permanent magnet turbogenerator/motor;  
8 determining that the output current of the permanent magnet turbogenerator/motor is not  
at a normal level in all phases;  
determining that the DC bus level is not below the turn on point of the brake resistor;  
applying the brake resistor to control DC bus voltage;  
determining that the output current of the permanent magnet turbogenerator/motor is at a  
normal level in all phases; and  
enabling the output power converter of the permanent magnet turbogenerator/motor to  
continue normal operation of the permanent magnet turbogenerator/motor.

16. A method of restarting a permanent magnet turbogenerator/motor, comprising them  
steps of:

3 determining that the permanent magnet turbogenerator/motor has a fatal fault present and  
4 is in the process of shutting down;  
5 determining that the permanent magnet turbogenerator/motor has less than a fixed  
6 number of restart attempts since the permanent magnet turbogenerator/motor was determined to  
7 have a fatal fault;

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8 determining that the permanent magnet turbogenerator/motor is in a recharge state where  
9 an internal energy storage device is being recharged as part of the shutdown process;

10 determining that a fixed period of time has elapsed since any previous attempt to restart  
11 the permanent magnet turbogenerator/motor;

12 attempt to clear the fault present in the permanent magnet turbogenerator/motor;

13 issue a restart command to the permanent magnet turbogenerator/motor if the fatal fault is  
14 successfully cleared; and

15 continue normal operation of the permanent magnet turbogenerator/motor.

17. A method of restarting a permanent magnet turbogenerator/motor, comprising them  
steps of:

determining that the permanent magnet turbogenerator/motor has a fatal fault present and  
is in the process of shutting down;

determining that the permanent magnet turbogenerator/motor has less than a fixed  
number of restart attempts since the permanent magnet turbogenerator/motor was determined to  
have a fatal fault;

determining that the permanent magnet turbogenerator/motor is in a cooldown state  
where the turbogenerator/motor is being rotated when combustion has ceased to lower the  
internal temperature as part of the shutdown process and that the internal temperature is below a  
cooldown restart temperature;

determining that a fixed period of time has elapsed since any previous attempt to restart  
the permanent magnet turbogenerator/motor;

attempt to clear the fault present in the permanent magnet turbogenerator/motor;

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15 issue a restart command to the permanent magnet turbogenerator/motor if the fatal fault is  
16 successfully cleared; and

17 continue normal operation of the permanent magnet turbogenerator/motor.

1 18. A method of restarting a permanent magnet turbogenerator/motor, comprising them  
2 steps of:

3 determining that the permanent magnet turbogenerator/motor has a fatal fault present and  
4 is in the process of shutting down;

5 determining that the permanent magnet turbogenerator/motor has less than a fixed  
6 number of restart attempts since the permanent magnet turbogenerator/motor was determined to  
have a fatal fault;

determining that the permanent magnet turbogenerator/motor is in a fault state;

determining that a fixed period of time has elapsed since any previous attempt to restart  
the permanent magnet turbogenerator/motor;

attempt to clear the fault present in the permanent magnet turbogenerator/motor;

issue a restart command to the permanent magnet turbogenerator/motor if the fatal fault is  
successfully cleared; and

continue normal operation of the permanent magnet turbogenerator/motor.

1 19. A method of restarting a permanent magnet turbogenerator/motor, comprising them  
2 steps of:

3 determining that the permanent magnet turbogenerator/motor has a fatal fault present and  
4 is in the process of shutting down;

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5 determining that the permanent magnet turbogenerator/motor has less than a fixed  
6 number of restart attempts since the permanent magnet turbogenerator/motor was determined to  
7 have a fatal fault;

8 determining that the permanent magnet turbogenerator/motor is in a standby state;  
9 issue a restart command to the permanent magnet turbogenerator/motor; and  
10 continue normal operation of the permanent magnet turbogenerator/motor.

1 20. A method of restarting a permanent magnet turbogenerator/motor, comprising them  
2 steps of:

3 determining that the permanent magnet turbogenerator/motor has a fatal fault present and  
is in the process of shutting down;

4 determining that the permanent magnet turbogenerator/motor has less than a fixed  
number of restart attempts since the permanent magnet turbogenerator/motor was determined to  
have a fatal fault;

5 determining that the permanent magnet turbogenerator/motor is in a recharge state where  
an internal energy storage device is being recharged as part of the shutdown process;

6 determining that a fixed period of time has not elapsed since any previous attempt to  
restart the permanent magnet turbogenerator/motor;

7 continue shutdown of the permanent magnet turbogenerator/motor.

8 21. A method of restarting a permanent magnet turbogenerator/motor, comprising them  
9 steps of:

10 determining that the permanent magnet turbogenerator/motor has a fatal fault present and  
11 is in the process of shutting down;

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5 determining that the permanent magnet turbogenerator/motor has less than a fixed  
6 number of restart attempts since the permanent magnet turbogenerator/motor was determined to  
7 have a fatal fault;

8 determining that the permanent magnet turbogenerator/motor is in a cooldown state  
9 where the turbogenerator/motor is being rotated when combustion has ceased to lower the  
10 internal temperature as part of the shutdown process and that the internal temperature is below a  
11 cooldown restart temperature;

12 determining that a fixed period of time has elapsed since any previous attempt to restart  
the permanent magnet turbogenerator/motor;

attempt to clear the fault present in the permanent magnet turbogenerator/motor; and  
continue shutdown of the permanent magnet turbogenerator/motor when the fault is not  
cleared.

22. A method of restarting a permanent magnet turbogenerator/motor, comprising them  
steps of:

determining that the permanent magnet turbogenerator/motor has a fatal fault present and  
is in the process of shutting down;

determining that the permanent magnet turbogenerator/motor has less than a fixed  
6 number of restart attempts since the permanent magnet turbogenerator/motor was determined to  
7 have a fatal fault;

8 determining that the permanent magnet turbogenerator/motor is in a fault state;

9 determining that a fixed period of time has elapsed since any previous attempt to restart  
10 the permanent magnet turbogenerator/motor;

11 attempt to clear the fault present in the permanent magnet turbogenerator/motor; and

12 continue shutdown of the permanent magnet turbogenerator/motor when the fault is not  
13 cleared.

1 23. A method of determining the fault condition of a permanent magnet  
2 turbogenerator/motor in a grid connect mode, comprising the steps of:

3 detecting an over-current condition;

4 determining that less than a fixed number of over-current events have occurred within a  
5 fixed period of time;

6 disabling the output power converter of the permanent magnet turbogenerator/motor;

7 determining that the output current of the permanent magnet turbogenerator/motor is at a  
normal level in all phases; and

enabling the output power converter of the permanent magnet turbogenerator/motor to  
continue normal operation of the permanent magnet turbogenerator/motor.

24. A method of determining the fault condition of a permanent magnet  
turbogenerator/motor in a grid connect mode, comprising the steps of:

detecting no output over-current;

detecting a loss of output current control or a loss of DC bus voltage control;

6 determining that more than a fixed number of warning faults has occurred within a fixed  
period of time;

7 reporting a grid fatal fault and initiating shutdown of the permanent magnet  
8 turbogenerator/motor.

1 25. A method of determining the fault condition of a permanent magnet  
2 turbogenerator/motor in a grid connect mode, comprising the steps of:

3 detecting no output over-current;

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4 detecting a loss of output current control or a loss of DC bus voltage control;  
5 determining that less than a fixed number of warning faults has occurred within a fixed  
6 period of time;  
7 reporting a grid unbalance warning fault;  
8 disabling the output power converter of the permanent magnet turbogenerator/motor;  
9 analyzing the grid voltage magnitude and frequency for an acceptable connection; and  
10 enabling the output power converter of the permanent magnet turbogenerator/motor to  
11 continue normal operation of the permanent magnet turbogenerator/motor.

26. A method of determining the fault condition of a permanent magnet  
turbogenerator/motor in a grid connect mode, comprising the steps of:

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detecting no output over-current;  
detecting a loss of output current control or a loss of DC bus voltage control;  
determining that less than a fixed number of warning faults has occurred within a fixed  
period of time;  
reporting a grid unbalance warning fault;  
disabling the output power converter of the permanent magnet turbogenerator/motor;  
analyzing the grid voltage magnitude and frequency for an unacceptable connection;  
10 determining that the maximum allowable reconnection time has expired; and  
11 reporting a grid fatal fault and initiating shutdown of the permanent magnet  
12 turbogenerator/motor.

1 27. A method of determining the fault condition of a permanent magnet  
2 turbogenerator/motor in a grid connect mode, comprising the steps of:

3 detecting no output over-current;

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4 detecting a loss of output current control or a loss of DC bus voltage control;  
5 determining that less than a fixed number of warning faults has occurred within a fixed  
6 period of time;  
7 reporting a grid unbalance warning fault;  
8 disabling the output power converter of the permanent magnet turbogenerator/motor;  
9 analyzing the grid voltage magnitude and frequency for an unacceptable connection;  
10 determining that the maximum allowable reconnection time has not expired;  
11 determining that the DC bus level is not below the turn on point of the brake resistor;  
12 applying the brake resistor to control DC bus voltage;  
determine that the grid is acceptable for connection; and  
enabling the output power converter of the permanent magnet turbogenerator/motor to  
continue normal operation of the permanent magnet turbogenerator/motor.

28. A method of determining the fault condition of a permanent magnet  
turbogenerator/motor in a grid connect mode, comprising the steps of:

detecting no output over-current;  
detecting a loss of output current control or a loss of DC bus voltage control;  
determining that less than a fixed number of warning faults has occurred within a fixed  
6 period of time;  
7 reporting a grid unbalance warning fault;  
8 disabling the output power converter of the permanent magnet turbogenerator/motor;  
9 analyzing the grid voltage magnitude and frequency for an unacceptable connection;  
10 determining that the maximum allowable reconnection time has not expired;  
11 determining that the DC bus level is below the turn on point of the brake resistor;

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12 determine that the grid is acceptable for connection; and  
13 enabling the output power converter of the permanent magnet turbogenerator/motor to  
14 continue normal operation of the permanent magnet turbogenerator/motor.

1 29. A method of determining the fault condition of a permanent magnet  
2 turbogenerator/motor in a grid connect mode, comprising the steps of:

3 detecting no output over-current;  
4 detecting a loss of output current control or a loss of DC bus voltage control;  
5 determining that less than a fixed number of warning faults has occurred within a fixed  
6 period of time;

7 reporting a grid unbalance warning fault;  
8 disabling the output power converter of the permanent magnet turbogenerator/motor;  
9 analyzing the grid voltage magnitude and frequency for an unacceptable connection;  
10 determining that the maximum allowable reconnection time has not expired;  
11 determining that the DC bus level is not below the turn on point of the brake resistor;  
12 applying the brake resistor to control DC bus voltage;  
13 determine that the grid is unacceptable for connection;  
14 determining that the maximum allowable reconnection time has expired; and  
15 reporting a grid fatal fault and initiating shutdown of the permanent magnet  
16 turbogenerator/motor.

1 30. A method of determining the fault condition of a permanent magnet  
2 turbogenerator/motor in a grid connect mode, comprising the steps of:

3 detecting an over-current condition;

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4 determining that less than a fixed number of over-current events have occurred within a  
5 fixed period of time;  
6 disabling the output power converter of the permanent magnet turbogenerator/motor;  
7 determining that the output current of the permanent magnet turbogenerator/motor is not  
8 at a normal level in all phases;  
9 determining that the DC bus level is not below the turn on point of the brake resistor;  
10 applying the brake resistor to control DC bus voltage;  
11 determining that the output current of the permanent magnet turbogenerator/motor is at a  
12 normal level in all phases; and  
enabling the output power converter of the permanent magnet turbogenerator/motor to  
continue normal operation of the permanent magnet turbogenerator/motor.

31. A method of determining the fault condition of a permanent magnet  
turbogenerator/motor in a grid connect mode, comprising the steps of:

detecting an over-current condition;  
determining that less than a fixed number of over-current events have occurred within a  
fixed period of time;  
disabling the output power converter of the permanent magnet turbogenerator/motor;  
7 determining that the output current of the permanent magnet turbogenerator/motor is not  
8 at a normal level in all phases;  
9 determining that the DC bus level is below the turn on point of the brake resistor;  
10 determining that the output current of the permanent magnet turbogenerator/motor is at a  
11 normal level in all phases; and

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12 enabling the output power converter of the permanent magnet turbogenerator/motor to  
13 continue normal operation of the permanent magnet turbogenerator/motor.

1 32. A method of determining the fault condition of a permanent magnet  
2 turbogenerator/motor in a grid connect mode, comprising the steps of:

3 detecting an over-current condition;

4 determining that more than a fixed number of over-current events have occurred within a  
5 fixed period of time;

6 determining that more than a fixed number of warning faults has occurred within a fixed  
7 period of time;

8 reporting a grid fatal fault and initiating shutdown of the permanent magnet  
9 turbogenerator/motor.

10 33. A method of determining the fault condition of a permanent magnet  
11 turbogenerator/motor in a standalone mode, comprising the steps of:

12 detecting an over-current condition;

13 determining that less than a fixed number of over-current events have occurred within a  
14 fixed period of time;

15 disabling the output power converter of the permanent magnet turbogenerator/motor;

16 determining that the output current of the permanent magnet turbogenerator/motor is at a  
17 normal level in all phases; and

18 enabling the output power converter of the permanent magnet turbogenerator/motor to  
19 continue normal operation of the permanent magnet turbogenerator/motor.

20 34. A method of determining the fault condition of a permanent magnet  
21 turbogenerator/motor in a standalone mode, comprising the steps of:

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3 detecting an over-current condition;  
4 determining that more than a fixed number of over current events have occurred within a  
5 fixed period of time;  
6 determining that less than a fixed number of warning faults has occurred within a fixed  
7 period of time;  
8 reporting a grid unbalance warning fault;  
9 disabling the output power converter of the permanent magnet turbogenerator/motor;  
10 resetting the output voltage control ready for a soft start; and  
enabling the output power converter of the permanent magnet turbogenerator/motor to  
continue normal operation of the permanent magnet turbogenerator/motor.

35. A method of determining the fault condition of a permanent magnet  
turbogenerator/motor in a standalone mode, comprising the steps of:

detecting an over-current condition;  
determining that less than a fixed number of over-current events have occurred within a  
fixed period of time;  
disabling the output power converter of the permanent magnet turbogenerator/motor;  
determining that the output current of the permanent magnet turbogenerator/motor is not  
8 at a normal level in all phases;  
9 determining that the DC bus level is below the turn on point of the brake resistor;  
10 determining that the output current of the permanent magnet turbogenerator/motor is at a  
11 normal level in all phases; and  
12 enabling the output power converter of the permanent magnet turbogenerator/motor to  
13 continue normal operation of the permanent magnet turbogenerator/motor.

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1 36. A method of determining the fault condition of a permanent magnet  
2 turbogenerator/motor in a standalone mode, comprising the steps of:  
3 detecting an over-current condition;  
4 determining that less than a fixed number of over-current events have occurred within a  
5 fixed period of time;  
6 disabling the output power converter of the permanent magnet turbogenerator/motor;  
7 determining that the output current of the permanent magnet turbogenerator/motor is not  
8 at a normal level in all phases;  
9 determining that the DC bus level is not below the turn-on point of the brake resistor;  
applying the brake resistor to control DC bus voltage;  
determining that the output current of the permanent magnet turbogenerator/motor is at a  
normal level in all phases; and  
enabling the output power converter of the permanent magnet turbogenerator/motor to  
continue normal operation of the permanent magnet turbogenerator/motor.

37. A permanent magnet turbogenerator/motor restarting system, comprising:  
means for determining that the permanent magnet turbogenerator/motor has a fatal fault  
present and is in the process of shutting down;

4 means for determining that the permanent magnet turbogenerator/motor has more than a  
5 fixed number of restart attempts since the permanent magnet turbogenerator/motor was  
6 determined to have a fatal fault; and

7 means to continue shutdown of the permanent magnet turbogenerator/motor.

1 38. A permanent magnet turbogenerator/motor restarting system, comprising:

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2 means for determining that the permanent magnet turbogenerator/motor has a fatal fault  
3 present and is in the process of shutting down;

4 means for determining that the permanent magnet turbogenerator/motor has less than a  
5 fixed number of restart attempts since the permanent magnet turbogenerator/motor was  
6 determined to have a fatal fault;

7 determining that the permanent magnet turbogenerator/motor is in a recharge state where  
8 an internal energy storage device is being recharged as part of the shutdown process;

9 means for determining that a fixed period of time has elapsed since any previous attempt  
to restart the permanent magnet turbogenerator/motor;

means to attempt to clear the fault present in the permanent magnet turbogenerator/motor;

means to issue a restart command to the permanent magnet turbogenerator/motor if the  
fatal fault is successfully cleared; and

means to continue normal operation of the permanent magnet turbogenerator/motor.

39. A permanent magnet turbogenerator/motor restarting system, comprising:

means for determining that the permanent magnet turbogenerator/motor has a fatal fault  
present and is in the process of shutting down;

means for determining that the permanent magnet turbogenerator/motor has less than a  
fixed number of restart attempts since the permanent magnet turbogenerator/motor was  
6 determined to have a fatal fault;

7 means for determining that the permanent magnet turbogenerator/motor is in a cooldown  
8 state where the turbogenerator/motor is being rotated when combustion has ceased to lower the  
9 internal temperature as part of the shutdown process and that the internal temperature is below a  
10 cooldown restart temperature;

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11 means for determining that a fixed period of time has elapsed since any previous attempt  
12 to restart the permanent magnet turbogenerator/motor;

13 means to attempt to clear the fault present in the permanent magnet turbogenerator/motor;

14 means to issue a restart command to the permanent magnet turbogenerator/motor if the  
15 fatal fault is successfully cleared; and

16 means to continue normal operation of the permanent magnet turbogenerator/motor.

1 40. A permanent magnet turbogenerator/motor restarting system, comprising:

2 means for determining that the permanent magnet turbogenerator/motor has a fatal fault  
present and is in the process of shutting down;

means for determining that the permanent magnet turbogenerator/motor has less than a  
fixed number of restart attempts since the permanent magnet turbogenerator/motor was  
determined to have a fatal fault;

means for determining that the permanent magnet turbogenerator/motor is in a fault state;

means for determining that a fixed period of time has elapsed since any previous attempt  
to restart the permanent magnet turbogenerator/motor;

means to attempt to clear the fault present in the permanent magnet turbogenerator/motor;

means to issue a restart command to the permanent magnet turbogenerator/motor if the  
12 fatal fault is successfully cleared; and

13 means to continue normal operation of the permanent magnet turbogenerator/motor.

1 41. A permanent magnet turbogenerator/motor restarting system, comprising:

2 means for determining that the permanent magnet turbogenerator/motor has a fatal fault  
3 present and is in the process of shutting down;

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4 means for determining that the permanent magnet turbogenerator/motor has less than a  
5 fixed number of restart attempts since the permanent magnet turbogenerator/motor was  
6 determined to have a fatal fault;

7 means for determining that the permanent magnet turbogenerator/motor is in a standby  
8 state;

9 means to issue a restart command to the permanent magnet turbogenerator/motor; and

10 means to continue normal operation of the permanent magnet turbogenerator/motor.

1 42. A permanent magnet turbogenerator/motor restarting system, comprising:

2 means for determining that the permanent magnet turbogenerator/motor has a fatal fault  
present and is in the process of shutting down;

3 means for determining that the permanent magnet turbogenerator/motor has less than a  
fixed number of restart attempts since the permanent magnet turbogenerator/motor was  
determined to have a fatal fault;

determining that the permanent magnet turbogenerator/motor is in a recharge state where  
an internal energy storage device is being recharged as part of the shutdown process;

means for determining that a fixed period of time has not elapsed since any previous  
attempt to restart the permanent magnet turbogenerator/motor;

11 means to continue shutdown of the permanent magnet turbogenerator/motor.

1 43. A permanent magnet turbogenerator/motor restarting system, comprising:

2 means for determining that the permanent magnet turbogenerator/motor has a fatal fault  
3 present and is in the process of shutting down;

4 means for determining that the permanent magnet turbogenerator/motor has less than a  
 5 fixed number of restart attempts since the permanent magnet turbogenerator/motor was  
 6 determined to have a fatal fault;

7 means for determining that the permanent magnet turbogenerator/motor is in a cooldown  
 8 state where the turbogenerator/motor is being rotated when combustion has ceased to lower the  
 9 internal temperature as part of the shutdown process and that the internal temperature is below a  
 10 cooldown restart temperature;

11 means for determining that a fixed period of time has elapsed since any previous attempt  
 12 to restart the permanent magnet turbogenerator/motor;

means to attempt to clear the fault present in the permanent magnet turbogenerator/motor;  
 and

means to continue shutdown of the permanent magnet turbogenerator/motor when the  
 fault is not cleared.

44. A permanent magnet turbogenerator/motor restarting system, comprising:

means for determining that the permanent magnet turbogenerator/motor has a fatal fault  
 present and is in the process of shutting down;

means for determining that the permanent magnet turbogenerator/motor has less than a  
 5 fixed number of restart attempts since the permanent magnet turbogenerator/motor was  
 6 determined to have a fatal fault;

7 means for determining that the permanent magnet turbogenerator/motor is in a fault state;

8 means for determining that a fixed period of time has elapsed since any previous attempt  
 9 to restart the permanent magnet turbogenerator/motor;

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means to attempt to clear the fault present in the permanent magnet turbogenerator/motor;  
and  
means to continue shutdown of the permanent magnet turbogenerator/motor when the  
fault is not cleared.

45. The permanent magnet turbogenerator/motor restarting system of claim 44 wherein  
said means for determining that the permanent magnet turbogenerator/motor has a fatal fault  
present and is in the process of shutting down, comprises:

means for detecting no output over-current;  
means for detecting a loss of output current control or a loss of DC bus voltage control;  
means for determining that less than a fixed number of warning faults has occurred  
within a fixed period of time;  
means for reporting a grid unbalance warning fault;  
means for disabling the output power converter of the permanent magnet  
turbogenerator/motor;  
means for analyzing the grid voltage magnitude and frequency for an unacceptable  
connection;  
means for determining that the maximum allowable reconnection time has not expired;  
means for determining that the DC bus level is not below the turn on point of the brake  
resistor;  
means for applying the brake resistor to control DC bus voltage;  
means for determining that the grid is acceptable for connection; and

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18 means for enabling the output power converter of the permanent magnet  
19 turbogenerator/motor to continue normal operation of the permanent magnet  
20 turbogenerator/motor.

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